



Primary 5  
Student Edition

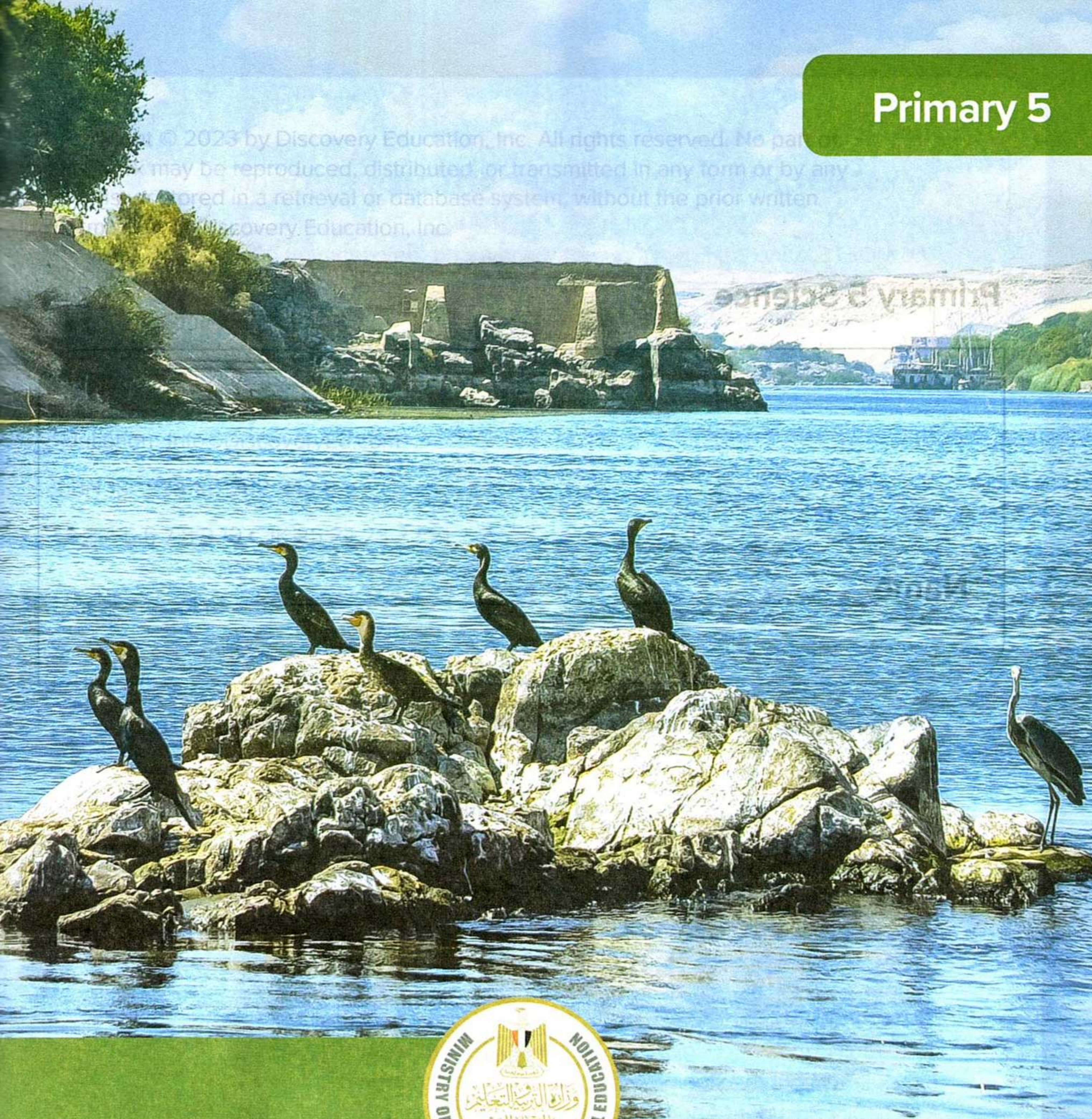
# Science Term 1

2023 - 2024





Primary 5



# Science Term 1



# Table of Contents

## Theme 1 | Systems

### Unit 1: Interactions of Organisms

#### Get Started

What I Already Know ..... 1

Anchor Phenomenon: Food chains and Food webs ..... 2

Unit Project Preview: Build a Miniature Ecosystem ..... 3

### Concept 1.1 Plant Needs

Lesson 1 ..... 5

Lesson 2 ..... 8

Lesson 3 ..... 12

Lesson 4 ..... 16

Lesson 5 ..... 20

### Concept 1.2 Energy Flow in Ecosystems

Lesson 1 ..... 25

Lesson 2 ..... 28

Lesson 3 ..... 31

Lesson 4 ..... 34

### Concept 1.3 Changes in Food Webs

Lesson 1 ..... 37

Lesson 2 ..... 41

Lesson 3 ..... 44

Lesson 4 ..... 46

### Unit Wrap-Up

Unit Project: Build a Miniature Ecosystem ..... 49

### Interdisciplinary Project

Waste Not, Want Not ..... 50

Assess your learning ..... 58



## Theme 2 | Matter and Energy

### Unit 2: Particles in Motion

#### Get Started

What I Already Know .....	61
Anchor Phenomenon: Sands of Time.....	62
Unit Project Preview: Slippery Sands.....	63

### Concept 2.1 Matter in the World around Us

Lesson 1.....	65
Lesson 2.....	67
Lesson 3.....	71
Lesson 4.....	74
Lesson 5.....	77

### Concept 2.2 Describing and Measuring Matter

Lesson 1.....	81
Lesson 2.....	84
Lesson 3.....	86
Lesson 4.....	91

### Concept 2.3 Comparing Changes in Matter

Lesson 1.....	95
Lesson 2.....	98
Lesson 3.....	102
Lesson 4.....	107
Lesson 5.....	111

### Unit Wrap-Up

Unit Project: Slippery Sands.....	114
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Assess your learning.....	116
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# Unit 1

# Interactions of

# Organisms



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# Get Started

## What I Already Know

Plants are all around us. As you walk to and from school, you can probably observe a variety of different plants. You probably know quite a bit about plants already. The first image shows a seed being planted. The last image shows plants on a windowsill. The image in the middle might give a clue as to why the plants on the windowsill are not surviving.



Write about what you know plants need to grow and survive, and make a recommendation on how to improve the growth or health of the plants in the window.

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**Talk Together** Have you ever planted seeds and observed their growth? Have you ever taken care of a plant in a garden or one inside your home or classroom? Share how you used your knowledge of plant needs to help the plants grow and thrive.

During this unit, you will learn that plants use specialized structures to convert light energy from the sun, air, and water to produce their own food. You will also learn about how different living organisms exist in an ecosystem in food chains and food webs, through interactions between producers, consumers, and decomposers. You will also learn how the energy from the sun flows through plants and animals. You will investigate what happens when a food chain is interrupted and what occurs when this happens in an ecosystem. Finally, you will bring together all that you learned and apply this knowledge to the unit project, Build a Miniature Ecosystem.



# Get Started

## Food Chains and Food Webs

This is a squirrel eating food. What does it look like this squirrel is eating? Have you ever seen a squirrel? Like all living things, squirrels need energy to stay alive. Where does the energy that this animal needs come from? Squirrels eat a variety of foods: leaves, fruit, insects, and even lizards. Larger animals eat squirrels to get their own energy needs. Can you think of other animals that eat for energy or organisms that provide energy to other living things?



Squirrel eating

What resources do plants need to grow and reproduce within an ecosystem?

How does energy move within an ecosystem? What can interrupt the flow of energy in an ecosystem?

**Life Skills** I can apply an idea in a new way.



# Unit Project Preview



## Solve Problems Like a Scientist

### Unit Project: Build a Miniature Ecosystem

In this project, you will use what you know about how living things interact with their environment to build a miniature ecosystem.



### Ask Questions About the Problem

Think about the different types of organisms that are found in a healthy ecosystem. Consider how they depend on the other living things in the community. What are some of the non-living things that are critical for survival in an ecosystem? Write some questions you can ask to learn more about ecosystems. As you learn about the components of a food web and the interactions that organisms have with their environment, record the answers to your questions.



# Plant Needs

## Student Objectives

By the end of this concept:

- ☐ I can use evidence to argue that plants use specialized structures to obtain the materials that they need to grow from sun, air, and water.
- ☐ I can develop a model of how energy moves through plants.
- ☐ I can develop a model of plant processes that use natural resources to complete life processes.
- ☐ I can compare the structure and function of the vascular system in plants with the circulatory system in humans.

## Key Vocabulary

- |   |   |                                  |
|---|---|----------------------------------|
| <input type="checkbox"/> arteries           | <input type="checkbox"/> nutrients      | <input type="checkbox"/> survive |
| <input type="checkbox"/> circulatory system | <input type="checkbox"/> phloem         | <input type="checkbox"/> system  |
| <input type="checkbox"/> digestive system   | <input type="checkbox"/> photosynthesis | <input type="checkbox"/> veins   |
| <input type="checkbox"/> seed dispersal     | <input type="checkbox"/> plant          | <input type="checkbox"/> vessels |
| <input type="checkbox"/> germinate          | <input type="checkbox"/> stem           | <input type="checkbox"/> xylem   |
| <input type="checkbox"/> glucose            | <input type="checkbox"/> stomata        |                                  |





## Activity 1

# Can You Explain?



Have you ever planted a seed and watched it grow into a plant? Think about what the plant needs to grow. How do the structures of a plant use water, air, and light to perform life processes?

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### Life Skills

I can share ideas I am not yet sure about.





## Activity 2

## Ask Questions Like a Scientist

## Tree Needs

You know that your body needs food and water every day to be healthy. What does a **plant** need to **survive**? How does it use resources to grow and thrive? Look at the photograph. Imagine what processes will happen after the tree is planted and it begins to grow from a seedling into a mature tree. Then, answer the questions that follow.

## Preparing to Plant

When you plant a tree, you want it to grow to be strong and healthy. Write what this student needs to know about planting a tree in order for the tree to grow successfully.

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Planting a Tree

## My Model of a Plant

Draw a model of a plant and show how the plant meets its needs. Your model can use words, pictures, symbols, or any combination of these choices.





### Activity 3

## Evaluate Like a Scientist



## What Do You Already Know About Plant Needs?

### Plants and Animals

How similar and different are the needs of plants and animals? Think about what animals and plants need to live and grow. Then, answer the questions.

What do plants need to live and grow? \_\_\_\_\_

How are the needs of plants similar to those of humans? \_\_\_\_\_

How are the needs different? \_\_\_\_\_

### Plant Needs

Think about what plants need to live and grow. Label each item listed as “Basic Plant Need” or “Not Basic Plant Need.”

Item	Basic Plant Need OR Not Basic Plant Need
Water	
Sugar	
Oxygen	
A forest	
Carbon dioxide	

### Plants and Food

How do plants get their food?

\_\_\_\_\_

How do the roots, stems, and leaves each help the plant get food?

\_\_\_\_\_





## Activity 4

## Investigate Like a Scientist



## Hands-On Investigation: Do Plants Need Soil?

You have discussed with classmates what plants need to grow. In this activity, you will test your ideas as you investigate whether plants need soil to grow. When a seed begins to grow, we say the seed is germinated. You will **germinate** seeds in wet paper towels, measure their growth, and then compare their growth to the growth of the seeds potted in soil.

### Make a Prediction

Consider the claim: Plants can grow without soil. Do you agree or disagree? Record your ideas and make a prediction about what will happen when we compare how plants grow with and without soil. Be sure to include reasoning for your prediction.

My prediction and reasoning:


### What materials do you need? (per group)

- Plastic cup, 250 mL
- Soil, potting
- Paper towels
- Seeds, fava or other beans
- Plastic zipper bags
- Water
- Pen or marker
- Metric ruler
- Lettuce or similar small plants (optional)

**Life Skills**

I can predict possible outcomes of an event.





## What Will You Do?

1. Use the water to wet the paper towel.
2. Place three seeds in the top half of the paper towel. Fold the bottom half of the towel up so that it covers the seeds. Place the paper towels inside the plastic zip bag and seal it.
3. Fill the plastic cup with potting soil. Plant the other three seeds in the soil. Water the seeds.
4. Label the bag and the cup with your name. Then, place the bag and the cup in a place where they can get sunlight.
5. Check the growth of seeds over the next several days. Dampen the paper towel and water the soil as needed.

Use the table provided to record your data. Measure the growth of each seed and record the measurements. Be sure to record the date of your observations and the location of the seeds, in the cup or the bag.

Seed Location: Towel or Cup	Measurement	Date	Other Observations

## Think About the Activity

Now that you have tested your prediction, review the results by answering the following questions. Be sure to record important details for evidence and be complete in your reasoning.

How much did the seeds that were placed in the paper towels grow? How did they compare with the seeds planted in soil?

Did the growth of the seeds, both in soil and in paper towels, match your initial claim? If not, how was it different?

Based on your observations, do seeds need soil to grow? Can plants grow entirely without soil? If so, will they grow better in soil? Why?





## Activity 5

## Investigate Like a Scientist

**Hands-On Investigation:  
Sunlight: A Basic Need**

In this investigation, you will test some of your ideas about plant growth. First, you will perform an experiment to look for any difference in how plants grow in the light and in the dark. Before you begin the investigation, read the text. Use what you learn to make predictions about the outcomes of your experiment. Once you have carried out the investigation, you will compare and contrast your observations with your classmates. You will set up the activity today and complete the activity later in this concept.

Trees and other plants make food through **photosynthesis**. Green plants use their leaves to collect sunlight and carbon dioxide from the air. Sunlight makes it possible for the water, taken in by the plant's roots, and carbon dioxide to combine. The result is sugar. This sugar gives the plant the energy it needs to grow. During photosynthesis, plants release oxygen into the air for us to breathe.

**What materials do you need? (per group)**

- 2 Plastic cups, 250 mL,
- Seeds, fava or other beans
- Soil
- Water
- Permanent marker, black

**Make a Prediction**

Develop a claim about what you think will happen to the plants.

What do you predict will happen to the plant in the light? and What do you predict will happen to the plant in the dark?



## What Will You Do?

1. Use the permanent marker to write your name on the cups and label the cups A and B.
2. Add soil to your cups. Place the bean seeds on the soil, one per cup, and cover the seeds with about 2 centimeters of soil. Add the same amount of water to each cup to moisten the soil.
3. Place cup A where it will receive light and place cup B in the dark.
4. Use the table that follows to record data. Collect information about your plants over a period of 5–10 days that will help you determine how important the role of sunlight is in the growth of plants.
5. Record the date each time you make observations. Make sure you are consistent about what you are observing. For example, if you are measuring height, do it with both cups, every time.

**Data Table for Plant Growth**

Date	Observations	Cup A (light)	Cup B (darkness)

After collecting data over several class periods, you will analyze your data. You should compare and contrast your observations with your classmates.

## Think About the Activity

What are the basic needs of plants? \_\_\_\_\_

What happened to the plant in the light? \_\_\_\_\_

Explain why light is important to the plant growth. Include sketches to support your conclusions.

**Life Skills** I can manage my time effectively.





## Activity 6

**Observe Like a Scientist****Parts of a Plant**

You investigated how different resources are important to plant survival. Now you will continue to research different plant parts that are involved in the process of turning resources into energy for the plant. Read the text. As you watch and read, add any new information to the diagram and descriptions you made in the previous activity.

**Roots**

Even though all plants look different, they have similar parts. The roots of the plant perform some very important functions. Roots anchor the plant in the soil. They draw water and nutrients from the soil, which are needed to make food. Plant roots have hairlike features called root hairs. Root hairs increase the amount of water and nutrients the plant can take in. Nutrients pass from the soil to the root.

**Stems**

Nutrients are transported to the rest of the plant through the stem in the tubes called vessels. Stems give the plant support and come in a variety of forms. Tree trunks and shrubs have a wood stem. Most flowers have upright stems. Some stems climb, such as vines. Some stems, known as tubers, extend underground, such as the potato plant. Other stems, called runners, run along the ground and help to form new plants.

**Leaves**

There are many kinds of leaves. Some are narrow and look like needles, like those on pine trees. Other leaves are flat and much wider. All leaves have tubes running through them called xylem. Xylem helps carry water from the roots to the stem and leaves. The most important function of leaves is to make food for the plant.



Leaves need water, carbon dioxide, and sunlight to make food. This process of making food is called photosynthesis.

## Structure and Function of Plant

A plant's roots absorb water from the soil and carry the water to the rest of the plant. Roots also carry **nutrients** from the soil to the plant. Water and nutrients move up a plant's **stem** through tubes called **vessels**. These vessels are also called **xylem**. Smaller vessels connect the stem to the leaves. This **system** helps feed and water all the parts of the plant. The air that plants need moves into leaves through tiny openings called **stomata**. Leaves also collect sunlight.

## Photosynthesis

Photosynthesis is a process that takes place inside the leaves. Leaves contain chlorophyll, which gives them their green color. Chlorophyll captures energy from sunlight. Green leaves use the light energy from the sun to combine the carbon dioxide from the air with water to manufacture nutrients (such as sugars, starches, fats, and proteins) that the plant needs to live. Another set of tubes, **phloem**, transport the food materials downward, from the leaves to the other parts of the plant. In addition to producing food for the plant, photosynthesis also produces oxygen that animals and people need to breathe. Life on Earth without plants would be impossible.







## Activity 7

# Investigate Like a Scientist

## Hands-On Investigation: Up the Stem

You have researched the structure of plants. Now, are you ready to use what you have learned to test your ideas? In this investigation, you will observe how plants move water. You will investigate what transport vessels in a plant look like and how they work to help a plant stay alive.

### Make a Prediction

Think about what you have learned from your research so far. Develop a claim about what you think will happen to the celery stalks when placed in the cup of colored water overnight.

### What materials do you need? (per group)

- Celery stalk
- White carnation flowers (optional)
- Plastic cups, 250 mL
- Food coloring
- Scissors
- Hand lens
- Water



### What Will You Do?

1. Select a stalk of celery. Examine the stem and any leaves closely. Record observations about how the stem looks in the "Before" section of the data table.
2. Fill a cup with water. Add food coloring to the cup of water. Snip about two centimeters off the bottom of the stalk and place it in the water.



3. Leave the stalk in the water cup and set aside where it will not be disturbed until the next day.
4. Observe the stalk. Record your observations.
5. Compare the actual outcome with your prediction.
6. Follow step-by-step directions given by the teacher to dissect the stalk.
7. Record detailed notes and drawings. Be sure to label the xylem.

Before	After
Comparison	

## Think About the Activity

How did your predictions about the outcome of the investigation differ from your observations?

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## Activity 8

## Analyze Like a Scientist

## Comparing Plant and Human Systems

You have learned a lot about the structure and function of plants. Have you ever wondered how human systems might be similar to plant systems? Read the article to determine how the human **circulatory system** is like the plant's **vascular system**.

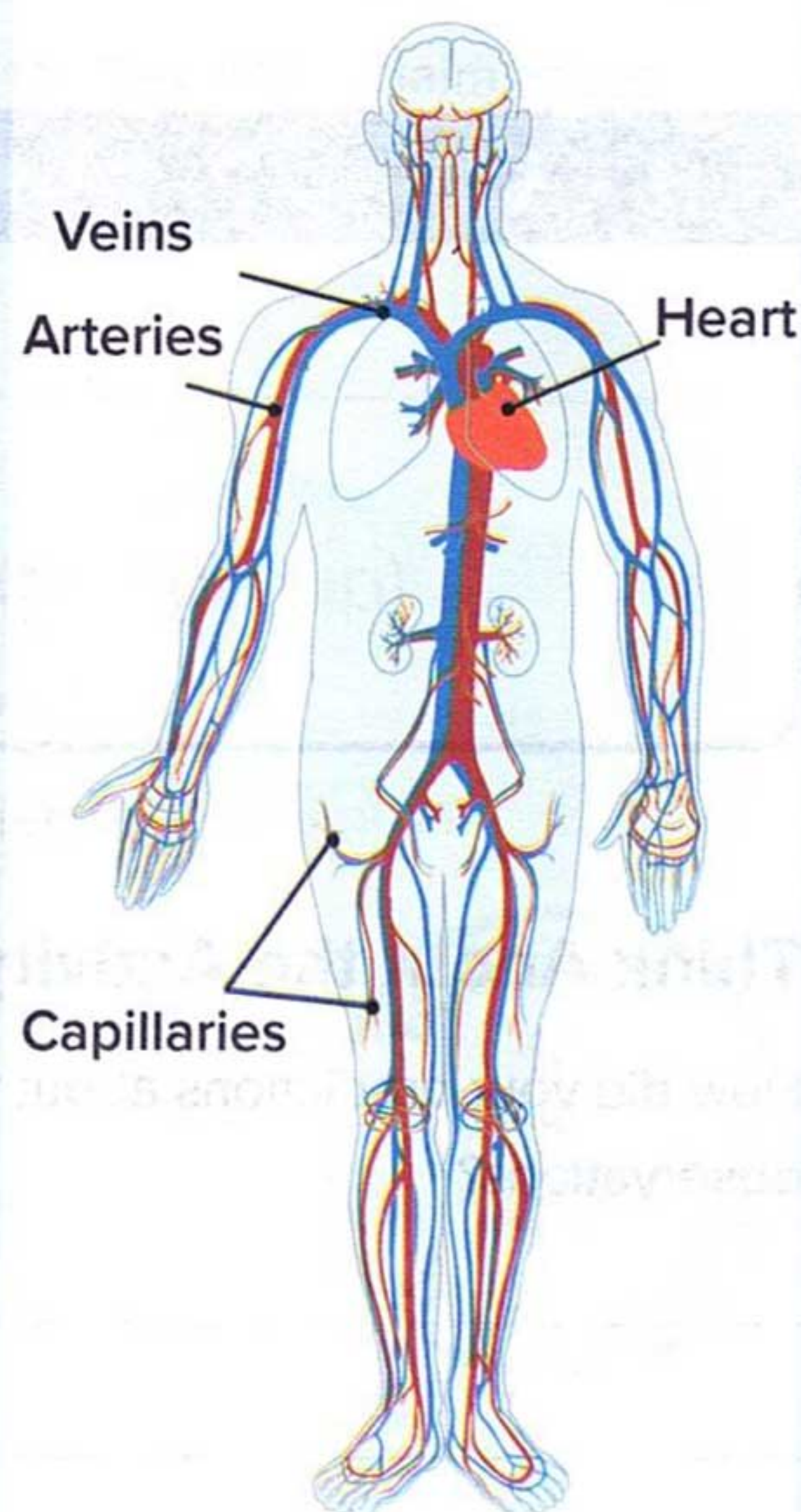
## Comparing Plant and Human Systems

## Need for Energy

Humans and plants both need energy and gases from the air to survive and grow. Plants can manufacture their own energy, **glucose**, through a process called photosynthesis. People, however, must eat food throughout the day for energy. Glucose and other nutrients enter our bodies through the **digestive system**. As we chew and swallow our food, nutrients are absorbed into the blood. Both plants and humans must take in gases from the air. Gases enter plants through the leaves. Air enters the human body through our mouth and nose and travels to the lungs, where oxygen is absorbed into circulating blood.

## The Human Body

The human body has a system that consists of the heart which consists of four chambers (two atria, two ventricles) and blood vessels (tubes) to transport nutrients and oxygen to the cells and organs. This is the circulatory system. The three different types of vessels in the human circulatory system are **arteries**, **veins** and **capillaries**.



Human Circulatory System

**Life Skills** I can apply an idea in a new way.



## Comparing Plant and Human Systems, *continued*

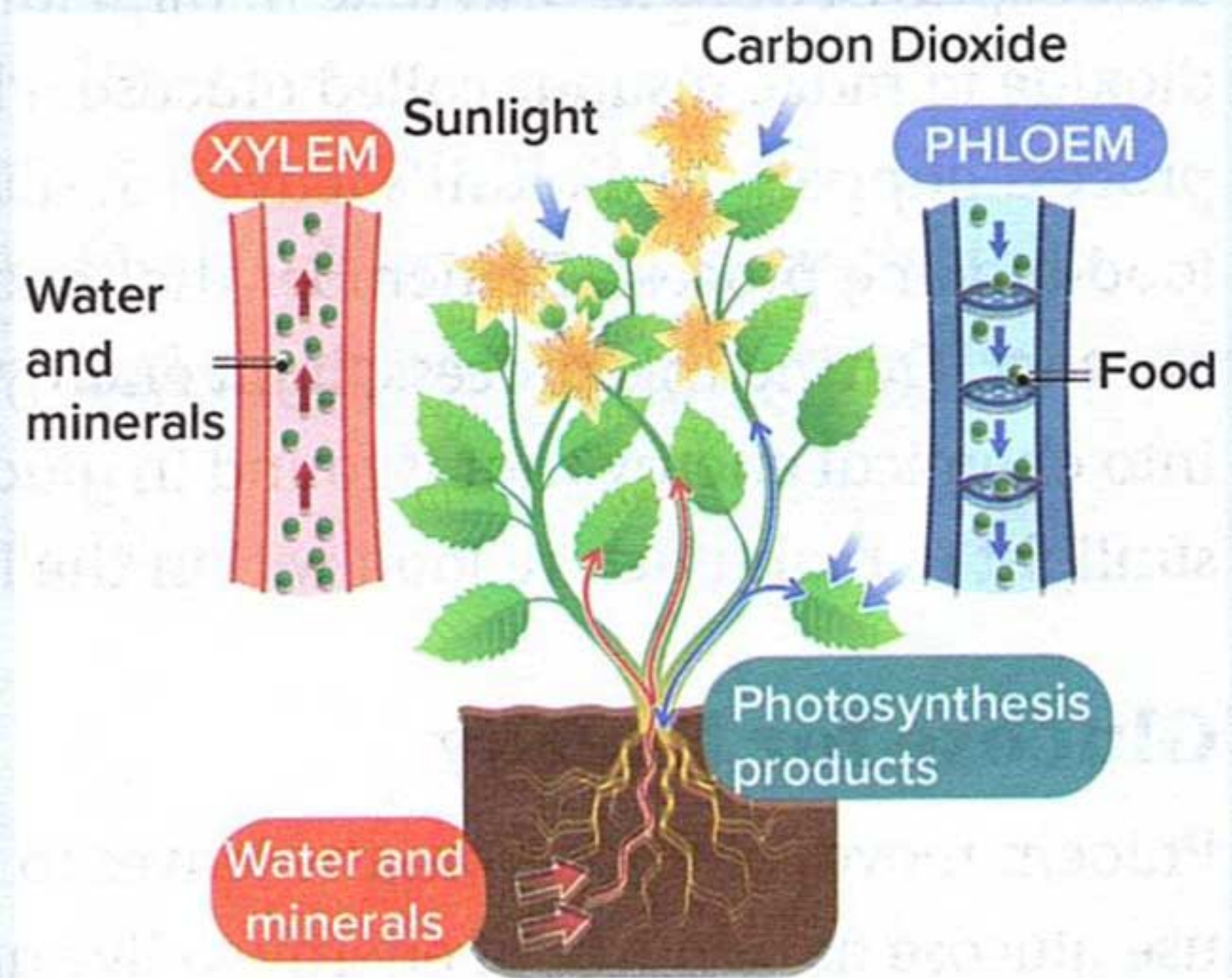
Blood moves in only one direction in a human's veins or arteries. Arteries carry blood that is rich with oxygen and glucose away from the heart to organs, muscles, bones, and cells so that the body can grow and heal. Veins return the blood that carries carbon dioxide and is low in nutrients and oxygen back to the heart for a recharge. You can probably see your veins and arteries through your skin on your hands or arms.

## Comparing the Human Body to Plants

Like the human body, a plant needs energy and gases from the air to grow and heal. In plants, these life-sustaining substances move through a system of tubes and vessels called the vascular system. Similar to the way arteries and veins pump blood in a specific direction to and from the heart, plants have one-way vessels that move important substances between organs.

## Transport System of Plants

Water and nutrients taken up by the roots must be transported to the leaves for food production to take place. Xylem tubes allow nutrient-rich water to travel upward through the plant. With the arrival of water, the leaves begin to manufacture glucose. Once energy production is complete, another set of tubes, the phloem, carries the glucose downward into other growing parts of the plant.



How is the transport system similar in plants and humans?



**Talk Together** What are some ways that you can keep your heart and the rest of your circulatory system healthy?





## Activity 9

**Analyze Like a Scientist****Plant Food**

Plants are able to manufacture food from materials that they obtain from their environment. Read the text describing the process that converts energy from the sun into food. Number each step of the process in the paragraphs that follow. Then, compare and discuss your numbering with a partner. Once you and your partner agree, Create a table showing the steps, put in the table the steps number and description, then compare the results with your colleague.

**Plant Food**

You already learned that plants have structures that take in water and nutrients from the soil and move them to other parts of the plant. Plants also have structures that capture sunlight and take in air. Plants then combine the water with carbon dioxide to make a sugar called glucose. Plant cells use this glucose for food. This process happens in a plant's leaves. Sunlight provides the energy needed for this food-making process. Remember that energy can be transformed from one form to another. During this process, light energy absorbed from sunlight is transformed into chemical energy that is found in glucose. This process by which plants use sunlight to manufacture food within the leaf is called photosynthesis.

**Glucose for Energy**

Phloem moves glucose from the leaves to the other parts of the plants. Plant cells use glucose as a source of energy to live and grow. As they use glucose, they release oxygen and water into the air. These materials are considered waste products of the photosynthesis process. Other living things, such as animals, depend on the oxygen that plants release during this process of food production.

**Life Skills** I can be reflective.





## Activity 10

## Observe Like a Scientist

## Flowers and Seeds

Plants use specific structures to obtain the materials they need to grow. You learned that the leaves play an important role in the process a plant uses to make its own food from those materials. What do you think the plant does with the food it makes? Read the text. Look for evidence of what plants do with the food they make.

When you think of flowers, you probably imagine large colorful plants seen in gardens. But some plants, such as grasses, have very small flowers that are hardly noticeable, and some flowers are not very colorful. Regardless of the shape, size, or color of flowers, they all have the same main job: to help plants reproduce. Plant reproduction is the process of making new plants. Flowers are the reproductive parts of many plants. Have you ever seen a sunflower? The small dark-colored objects in the center of the flower are seeds. If seeds receive air, water, and the correct temperature, they can grow into a new plant.



**Talk Together** Now, talk together about how plants use the food they make to reproduce. Why are flowers and seeds important to a plant?

## Life Skills

I can predict possible outcomes of an event.





## Activity 11

## Investigate Like a Scientist

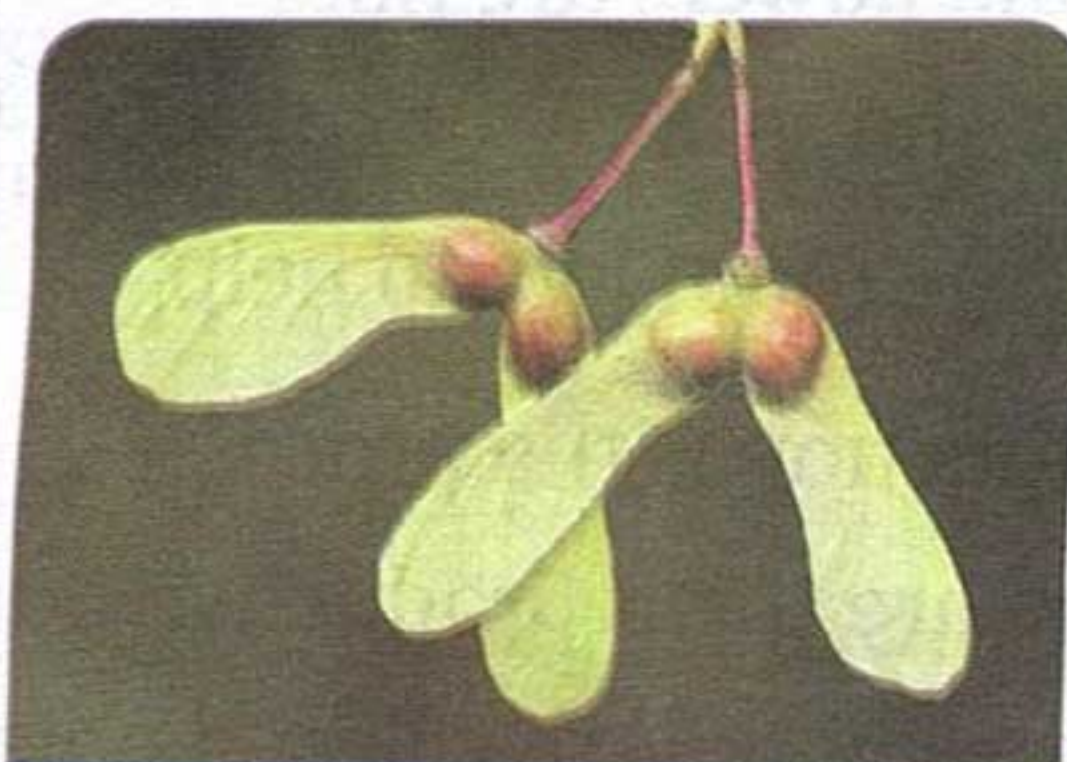
**Hands-On Investigation:  
Seed Dispersal**

You learned that plants have many structures to help obtain materials and create their own food. One way many plants use the energy from the food they make is in the production of seeds. In this activity, you will design and test a model of an imaginary seed to investigate how seeds are transported from place to place. This is called **seed dispersal**.

First, look at the seeds in the images that follow. What are some of the properties that you notice? Then, listen as your teacher describes the different ways seeds travel. Decide how you think the seeds in the images move from place to place.



Coconut



Maple Seeds



Tomato Seeds



Burdock Seeds



Apple Seeds



Dandelion Seeds

**Make a Prediction**

You are going to model one way that a seed can effectively be transported from one place to another. Write or draw your predictions.

**Life Skills** I can apply an idea in a new way.



Which method of dispersal do you think is highly effective at moving seeds from one place to another?

How will you make dispersal for your model seed possible? Draw what your model seed will look like in the space provided.

## What materials do you need? (per group)

- Paper
- Pencils
- Pan of water
- Sample seeds or images of seeds
- Fan or access to an outside area
- Piece of carpet or fuzzy blanket
- A variety of model-building materials



## What Will You Do?

As you complete the following steps, record your observations in the table provided.

### Part 1: Traveling Seeds

1. Observe a variety of different types of seeds. Think about the structures that help these seeds travel using either water, wind, or animal transport.
2. Decide with your team which method of seed travel you would like to investigate—water, wind, or animal transport, and review the materials available to create your seed model, and draw sketch for it.



3. Present and discuss your sketch with your team. With your team, choose one design to build, and build your seed model with your team.
4. Test your model using either the pan of water, an area with moving air, or the piece of carpet or fuzzy blanket (representing animal fur). Record the results of your test.

### Part 2: Organize Data

5. With your group, evaluate your model and discuss how successful it was.
6. Share your model and results with the rest of the class.
7. As a class, discuss which models and travel methods were most effective.

Record your results in the table provided.

Notes: Which method is your model seed designed for?	Observations: What happened?

### Think About the Activity

What parts of your model seed aid in dispersal?

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What kinds of seeds do you think are the most easily transported? Why?

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Did your model function as you predicted it would? Explain.

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How could you improve your model or test?

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## Activity 12

## Record Evidence Like a Scientist

## Tree Needs

Now that you have learned about plant needs, look again at the image Planting a Tree. You first saw this in Wonder.

How can you describe Planting a Tree now?

How is your explanation different from before?

Look at the Can You Explain? question. You first read this question at the beginning of the concept.



## Can You Explain?

How do the structures of a plant use water, air, and light to perform life processes?

Now, you will use your new ideas about plant needs to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, first write your claim. A claim is a one-sentence answer to the question you investigated. It answers, what can you conclude? It should not start with *yes* or *no*. My claim:

Next, record the evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations. Evidence:

Now, write your scientific explanation and include your reasoning. Scientific explanation with reasoning:

**Life Skills** I can apply an idea in a new way.



# Energy Flow in Ecosystems

## Student Objectives

By the end of this concept:

- ☐ I can develop a model to show how energy moves through an ecosystem.
- ☐ I can create a model to explain the different roles that organisms play in an ecosystem.
- ☐ I can explain how the health of each type of organism in an ecosystem impacts the overall health of the community.

## Key Vocabulary

- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| <input type="checkbox"/> consumers   | <input type="checkbox"/> interact   |
| <input type="checkbox"/> cycle       | <input type="checkbox"/> predators  |
| <input type="checkbox"/> decomposers | <input type="checkbox"/> prey       |
| <input type="checkbox"/> ecosystem   | <input type="checkbox"/> producers  |
| <input type="checkbox"/> food chain  | <input type="checkbox"/> scavengers |
| <input type="checkbox"/> food web    |                                     |





## Activity 1

## Can You Explain?



You probably know a lot about ecosystems already. An **ecosystem** consists of organisms and their environment, and includes both living organisms and non-living things. Plants, animals, and even humans are all part of an ecosystem. How does energy flow through an ecosystem? Look at the image and record what you already know about energy in ecosystems.

How does energy flow through an ecosystem?

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**Life Skills**

I can share ideas I am not yet sure about.





## Activity 2

# Ask Questions Like a Scientist

## How Hawks Get Energy?

Have you ever seen a hawk? Imagine what a hawk must do to survive. Look at the photograph. Then, answer the questions that follow. Record your answers in the space provided.



Osprey (Also Known As Sea Hawk)

Think about what you have seen or read about hawks. What do you wonder about how a hawk gets energy in its environment?

I wonder . . .

Draw a model of how a hawk interacts with the environment. You can use words, images, and symbols.







### Activity 3

## Evaluate Like a Scientist









## What Do You Already Know About Energy Flow in Ecosystems?

In the previous activities, you began thinking about how plants and animals get energy. Now you will summarize your ideas before delving deeper into how energy flows in ecosystems. Think about the needs of plants and animals. Answer each question in the space provided.

### What Do Living Organisms Eat?

Join the living organism with its food.

Animal	 Caracal	 Rabbit	 Bird
Food	 Worms	 Mouse	 Grass

### Ecosystems

Read each question. Then, write your answers in the spaces provided.

What is an ecosystem? and What are some examples of ecosystems?

What is the relationship between sunlight and the energy we get from our food?





## Activity 4

## Analyze Like a Scientist

**Food Is Energy**

Think back to your early ideas about how to answer the Can You Explain? question or any questions you had during Wonder. Next, read the text. Circle evidence that supports your early ideas. If information goes against your early ideas, underline the information.

**Food Is Energy****How Do We Get Energy?**

How do you get the energy you need to think, breathe, move, or do anything else? Some activities, such as hard work or exercise, require a lot of energy. Your body still uses some energy even when you sleep. Food and the oxygen we breathe provide the energy we need throughout the day.



Children Running

**The Primary Source of Energy**

All living things need energy to live, grow, and carry out life processes. The primary source of energy for all organisms on Earth is the sun. Plants absorb sunlight through their leaves and use the sun's energy to make their own food. Sunlight provides the energy for plants to convert water and carbon dioxide from the air into glucose. Glucose is the sugar that plants use to sustain life. This process, known as photosynthesis, is fundamental to life on Earth.

**Energy from the Environment**

Living organisms can either produce their own food or get food from other organisms. Animals, including humans, cannot make their own food. Instead, animals get energy from the environment in which they live. Some animals eat plants as food. Some eat other animals that eat plants. Some eat both plants and animals. In this way, energy produced from the sun passes through all life on Earth.





## Activity 5

## Observe Like a Scientist



## Food Chains

You already know that energy is the key to keeping organisms alive. How does energy move through an ecosystem? Read the text. Write down any questions or important facts that you would like to share later. Be ready to discuss with your group.

## Energy for Life

All organisms need energy to live. While some living things can produce their own food, but the most cannot. This means that most organisms need to eat to get the energy they need to survive. Living organisms feed on one another. In an ecosystem energy is passed on through food chains of organisms.

## Producers

The first link in any **food chain** is the food **producers**. Plants use energy from the sun to produce food. Producers are able to produce food in the form of energy-rich glucose. Nearly all of the producers on Earth are plants.

## Consumers

The second link in a food chain is the primary **consumers**. These are animals that eat plants. In this way, energy begins to move up the food chain. Many insects are primary consumers.

Next are the secondary consumers that eat the primary consumers. Birds are secondary consumers because they eat insects and other organisms that live on a diet of plants.

The next level of consumers is the tertiary consumers that eat the secondary consumers. Tertiary consumers are often large meat-eating animals, like alligators.

## Decomposers

The final link in the food chain is the **decomposers**. Fungi and bacteria are two examples of decomposers. Decomposers recycle nutrients back into the ecosystem through the process of decomposition. Animals such as worms and millipedes eat dead matter. The waste they produce is rich in nutrients. This makes the soil fertile for plant growth.





## Activity 6

## Analyze Like a Scientist

## Energy Flow

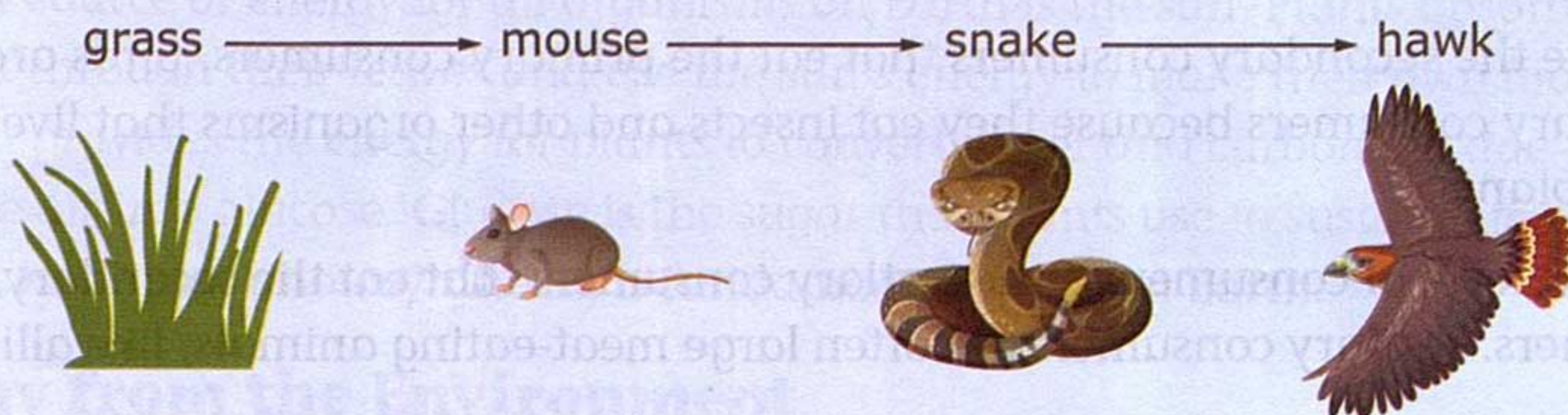
Let's gather more information to understand food chains. Read the text. Underline evidence that you could use to investigate what would happen if an organism was removed. Record the evidence in the space provided.

## All Organisms Need Energy

Organisms that do not capture energy directly from the sun need other organisms to obtain energy. Food chains show how energy passes from one organism to another in an ecosystem. The food chain shows the food, or energy, relationships among organisms within specific ecosystems.

## One Example of a Food Chain

Grass makes its own food using energy from sunlight. A mouse eats the grass to get energy. A snake then eats the mouse, and a hawk then eats the snake. The energy from the sun passes to the grass, then to the mouse and snake, and finally to the hawk. Unlike grass, animals like the mouse, snake, and hawk cannot make their own food from sunlight. The following food chain shows the relationship among these organisms.



## Predator and Prey

In this food chain, the hawk and the snake are **predators**. They also hunt other animals as **prey**. The snake and the mouse are prey. They are hunted by other animals for food. Both predators and prey pass food and energy through the food chain.





## Activity 7

# Evaluate Like a Scientist



## Food Chain

You have seen and read about some examples of food chains. Now, let's make a model of a food chain. Write the names of the organisms in the correct boxes to make a food chain.

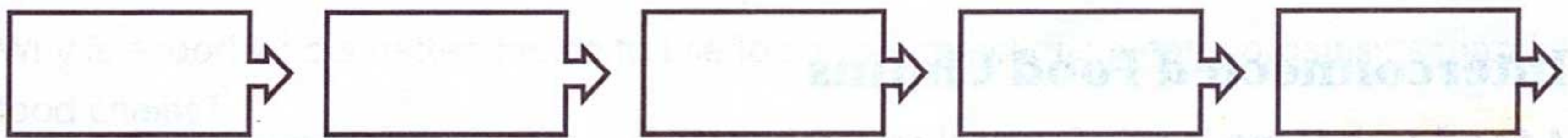
bird

grass

grasshopper

hawk

snake



How would you add a grass-eating beetle that the bird eats to this model?

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**Life Skills** I can make careful decisions.





## Activity 8

## Analyze Like a Scientist

## Food Webs

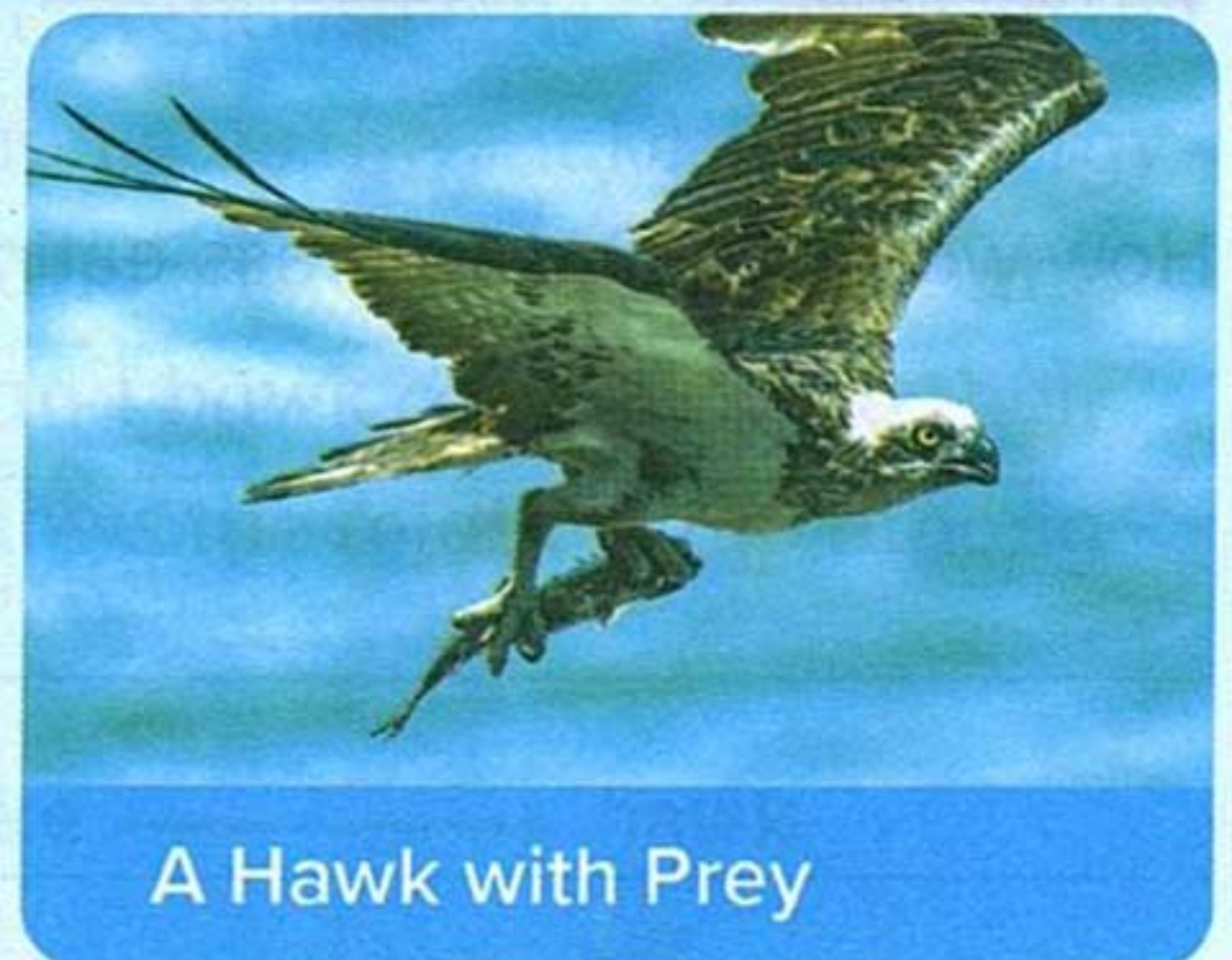
You learned that a food chain shows feeding relationships between organisms. Most organisms are a part of several food chains. Read the text. Think about how the organisms you observed or read about in this concept **interact** with one another. Then, write the names of the organisms in the correct column of the table.

## Interactions Among Organisms

Think about the different foods you eat. Imagine those foods are connected to you by lines in a web. All living organisms, including you, interact in food webs. We can draw these webs to show how organisms are connected within ecosystems.

## Interconnected Food Chains

A **food web** is made up of several interconnected food chains. Food chains show the relationship of food and energy that passes from one organism to another. All food chains begin with an energy source, like the sun. The sun provides energy for the producers. Plants are producers. Plants provide food for a series of consumers, which may eat only plants or may eat both plants and animals. Consumers who eat other animals are predators and the animals they eat are the prey. The ways in which many food chains intersect within an ecosystem form a food web.



A Hawk with Prey

Producers	Predators	Prey





## Activity 9

## Evaluate Like a Scientist



## Interactions in Food Webs

You have now learned a lot about food webs. Using what you know and have observed, answer the three questions that follow to help you communicate your ideas about food webs.

How do food webs model interactions among organisms in an ecosystem?

How does a food web represent a system for the transfer of energy?

Why is a food web a better choice to use to show interactions among organisms than food chains?

Now, draw a diagram of your own food web for an ecosystem of your choosing. Be sure to include at least five different organisms in your food web.





## Activity 10

## Record Evidence Like a Scientist

## How Hawks Get Energy?

Now that you have learned about how energy moves through an ecosystem, look again at this image. You first saw this in Wonder.

How can you describe How Hawks Get Energy now?

How is your explanation different from before?

Look at the Can You Explain? question. You first read this question at the beginning of the concept.



## Can You Explain?

How does energy flow through an ecosystem?

Now you will use your new ideas about how energy moves through an ecosystem to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, first write your claim. A claim is a one-sentence answer to the question you investigated. It answers, What can you conclude? It should not start with *yes* or *no*. My claim:

Next, record the evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations. Evidence:

Now, write your scientific explanation and include your reasoning.

Scientific explanation with reasoning:

**Life Skills** I can apply an idea in a new way.



# STEM in Action



## Activity 11

## Analyze Like a Scientist

### Careers in Ecology: Plant-Community Ecologist

Read the text. Then, discuss the questions.

We might think of somebody wearing a white lab coat and standing inside in a lab. But Dr. Barak gets to do her research out on the prairie. She always loved animals and plants growing up, but she did not know that there was an actual science where you could study animals and plants she learned about ecology. She took a class in restoration ecology and that was where she learned about, rebuilding habitats that are damaged.



### Seed Dispersal

An interesting thing Dr. Barak has learned about plants is that different plants need different ways to transport or disperse their seeds. One plant has seeds that are really sticky. Their seeds can stick to your clothing. You never know where you might leave them. Other plants have seeds that are dispersed by the wind. These seeds are released from the plant when the plant is ready. The seeds fly away to new habitats to grow in other places.

### Careers in Ecology

When a human encourages to spend some time observing the natural world. If you are interested in the natural world, consider participating in conservation or restoration work in your area to help take care of plants and animals. Your interest in nature now could lead to a career in ecology later in the future.



**Talk Together** Think about the task of scientist when he make rebuilding habitats that are damaged when planting plants single or in groups and how does this affects its growth and its stability

**Life Skills** I can predict possible outcomes of an event.



# Changes in Food Webs

## Student Objectives

By the end of this concept:

- ☐ I can demonstrate through modeling how changes in an ecosystem can disrupt a food web.
- ☐ I can construct an explanation about how human activity can negatively impact an ecosystem.
- ☐ I can argue for possible solutions to environmental problems that can restore the health of an ecosystem.

## Key Vocabulary

- |   |                                      |
|---|--------------------------------------|
| <input type="checkbox"/> climate        | <input type="checkbox"/> nursery     |
| <input type="checkbox"/> conservation   | <input type="checkbox"/> pollution   |
| <input type="checkbox"/> habitat        | <input type="checkbox"/> population  |
| <input type="checkbox"/> microorganisms | <input type="checkbox"/> restoration |
| <input type="checkbox"/> microplastics  |                                      |





### Activity 1

## Can You Explain?



Look at the image of the dried lake or river. Is this a healthy ecosystem? Think about what you already know about ecosystems and food webs.

What might happen to a food web when an organism or the environment changes within an ecosystem?

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### Life Skills

I can share ideas I am not yet sure about.





Activity 2

# Ask Questions Like a Scientist

## Protecting Ecosystems

As you read the text, think about what you know regarding the protection of water ecosystems from **pollution** or other human activity.

Palau is an island that uses various **conservation** programs to protect the marine environment and its resources. On an island, it is impossible to separate what happens on land from what happens in the marine environment. Therefore, Palau must closely manage land activities in order to control the quality of the marine environment.



Palau also needs well-designed, protected marine environments in place. One way to create these protected environments is to work with fishers to make sure they are not overfishing the coral reefs.

Have you ever been to the beach or swum in an ocean? Think about what can be done to protect ecosystems. Write what you wonder about protecting ecosystems.

I wonder ...

I wonder ...

Life Skills

I can predict possible outcomes of an event.





### Activity 3

## Evaluate Like a Scientist

# What Do You Already Know About How Food Webs Can Change?

### If . . . Then

We know that sometimes ecosystems change. Does that mean food webs can change too? Think about what might affect an ecosystem and possibly a food web. Read each statement in the first column. Finish each statement in the next column with what might happen next. Write why you think these results might occur. Continue until you have completed each statement.

If	Then
If there is a gentle rain in the desert,	then the desert ecosystem might _____ because _____.
If there is a heavy rain in the desert,	then the desert ecosystem might _____ because _____.
If there is a drought and all the grass dies,	then the food web in the ecosystem might _____ because _____.
If there are many top predators in the food web,	then the organisms in the food web might _____ because _____.

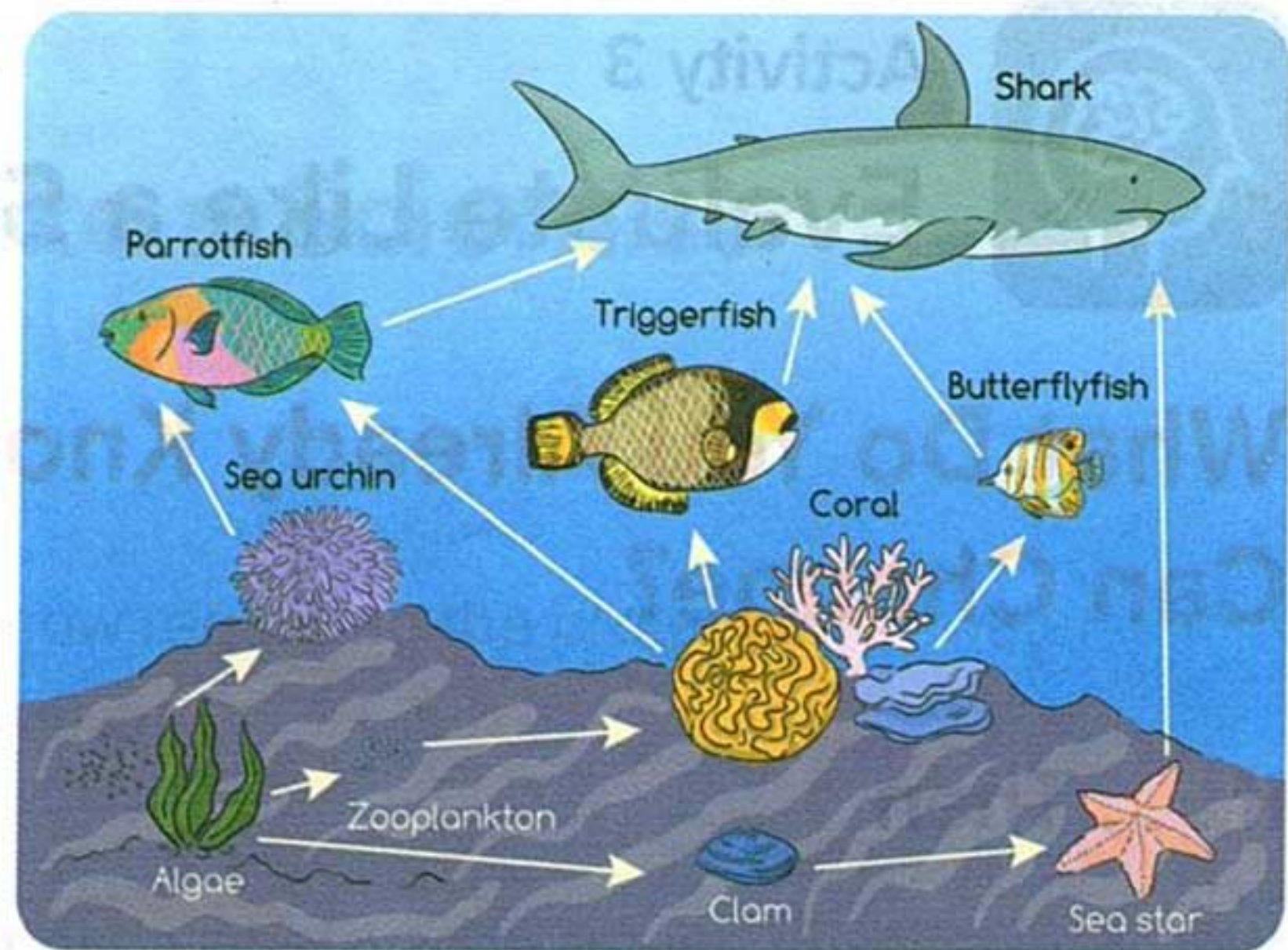


## Food Webs

Look at the image of a marine food web.

Think about how the food web works.

Describe which organisms eat other organisms, in the food web.



## My Ecosystem

You have already thought about food chains and food webs. Now think about an ecosystem in your own area. Tell the story of your own ecosystem through a four-panel drawing. Show how energy flows from the sun, to producers, all the way to decomposition.

Be sure to label producers, consumers, and decomposers in your drawings.


**Life Skills** I can apply an idea in a new way.





## Activity 4

## Investigate Like a Scientist



## Hands-On Investigation: Energy Flow Body Model

### Flow of Energy

In this activity, you will model the flow of energy through a food web. As you model the process, keep in mind how energy is used.

### Make a Prediction

How can we use the materials provided to model energy flow in an ecosystem?

### What Will You Do?

1. Your teacher will assign you a role to play from a picture of a food web. You will interact with the other “organisms” in your class according to the role you play (producers, consumers, decomposers, predator, prey).
2. Use your paper squares to represent energy.
3. Play a game of predator-prey tag, in which you capture or lose your energy (represented by paper squares).
4. Think about what this game reveals about the flow of energy in the ecosystem. Use what you learned while participating in the modeling activity to answer the questions that follow.

### What materials do you need? (per group)

- Index cards labeled with organisms
- Picture of a food web
- Paper squares, 3 cm x 3 cm, 10 per student

### Think About the Activity

What is happening to the energy in this system?

Where in this system are energy changes occurring?





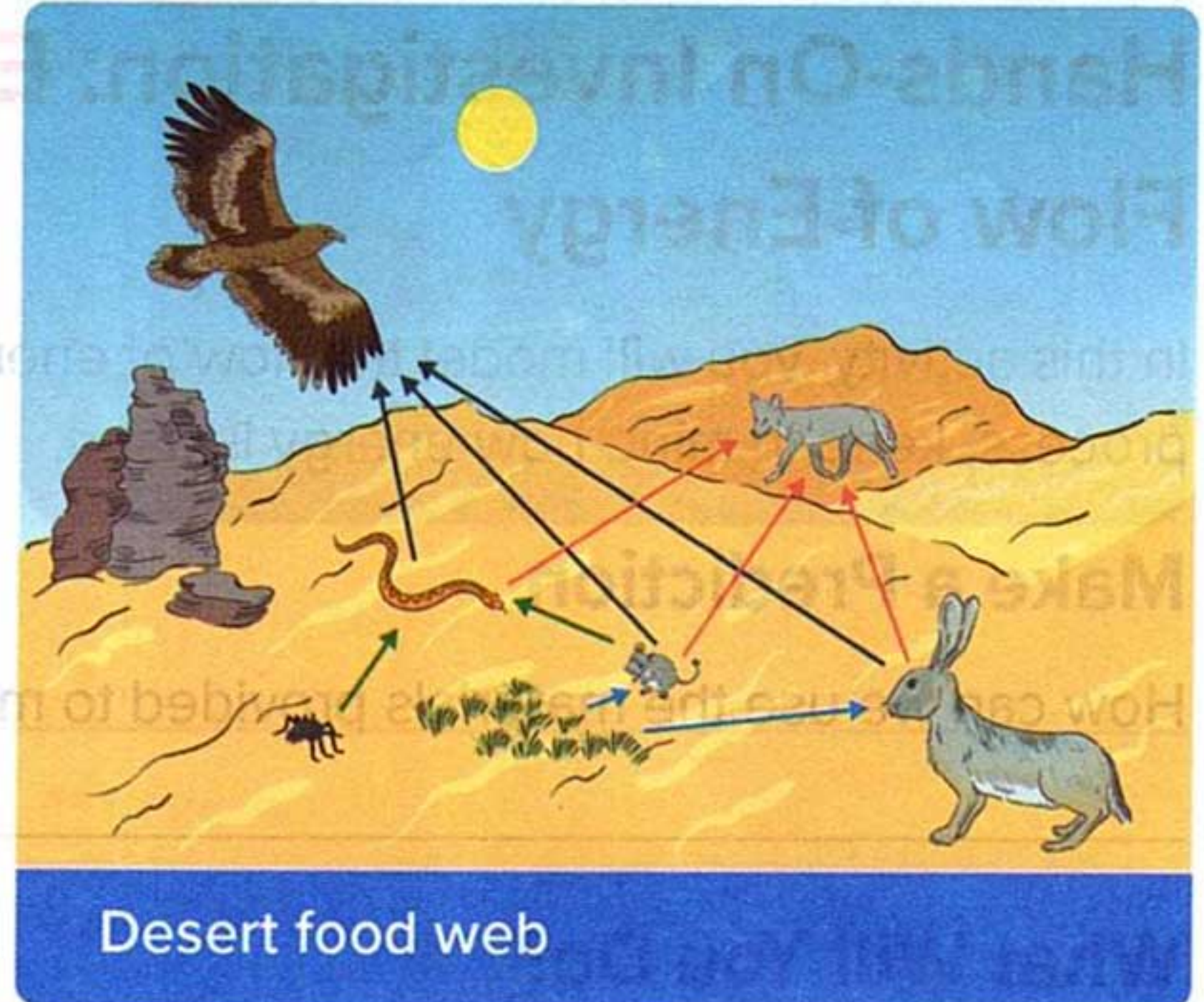


**Activity 5**

**Observe Like a Scientist**

**Desert Food Web**

A food web shows many different feeding relationships among organisms in an ecosystem. Recall that the arrows show the direction that energy flows. Look at the image of the desert food web. Then, answer the questions that follow.



What would happen to the hare if all the grass were removed from the area?

What would happen to the eagle if all the grass were removed from the area?

How does energy travel from the grass to the eagle?

**Life Skills** I can predict possible outcomes of an event.





## Activity 6

## Observe Like a Scientist



## Population Changes

Does one species in an ecosystem affect the **population** of another species? Explore population changes in an ecosystem. Read the text. Then, answer the questions.

Seabirds nest on top of mountain cliffs. They dive deep down into the sea to feed on small fish. The fish feed on **microorganisms** floating on the surface of the sea. These fish are the main source of food for many seabirds. Microorganisms can make their own food.



They are found in cold water habitats. These microorganisms are the producers in the marine food web. Small fish feed on these microorganisms. The microorganisms need cold water to survive. If the **climate** changes and the water becomes warm, they will move toward an area where the water is cooler. The small fish that feed on microorganisms will also move to a new **habitat**. The seabirds will then no longer have a food source. Some will find a new habitat, while others will die.

What does the phrase *population change* mean?

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How can change in the climate affect the population of a species?

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Why does change in the population of one species affect the population of other species?

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**Activity 7**

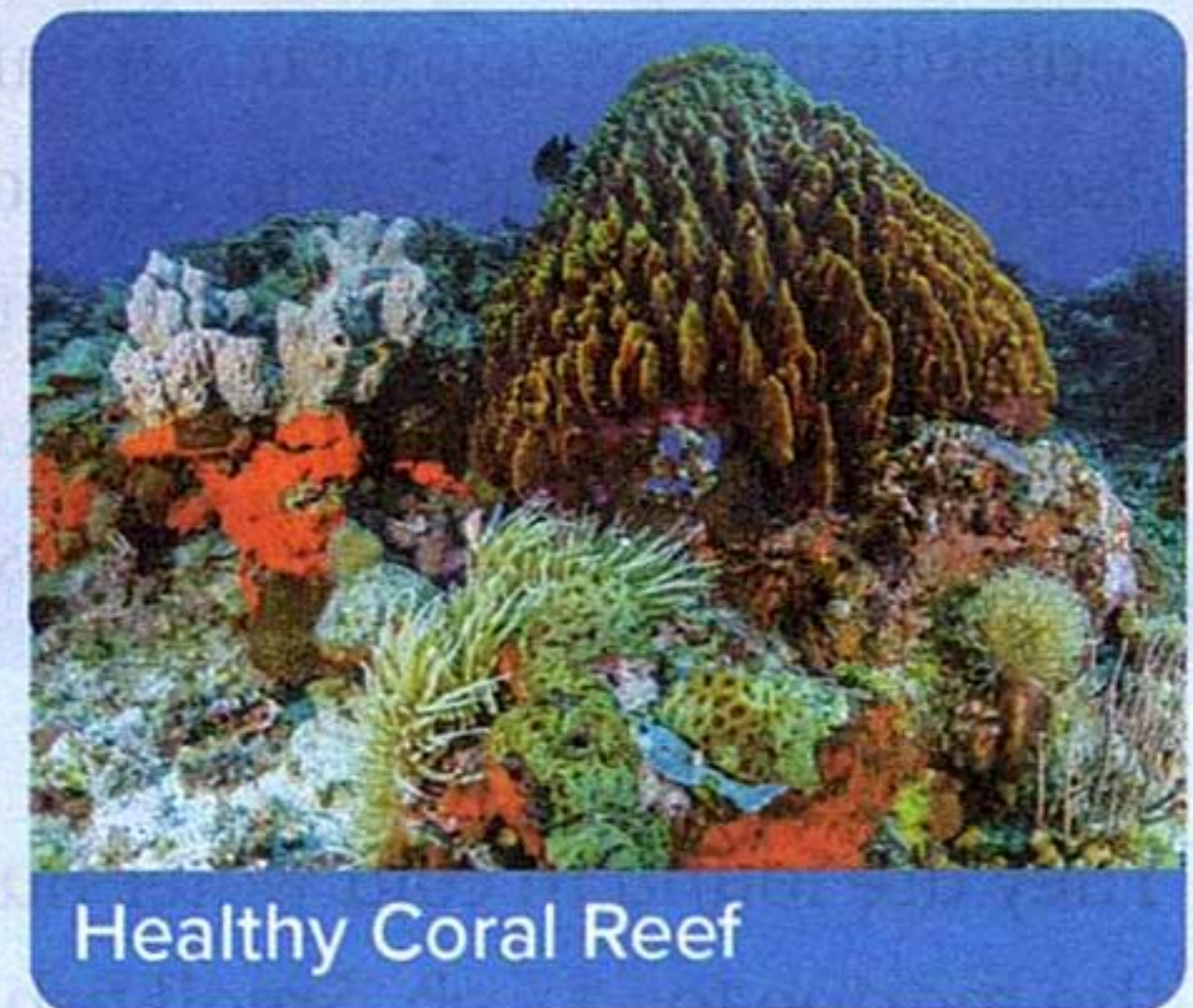
**Analyze Like a Scientist**



**Habitat Loss**

Think about what you have learned about ocean food webs. Read the text and compare the images. Then, answer the questions.

Habitats provide organisms with all the things they need to survive. Humans change habitats. They do this when they add buildings and roads. They do this when they add substances to the water or overfish in the ocean. Human activity can also impact the weather and nonliving factors in an ecosystem, such as the temperature of ocean water. All of these changes can cause habitat loss. Habitat loss is one of the main causes of extinction.



**Healthy Coral Reef**

**Coral Reefs**

Coral reefs are some of the most diverse and valuable ecosystems on Earth. Coral reefs support large numbers of species, including fish, other corals, and a variety of other sea life. Coral reefs are important habitats for living organisms. Coral reefs are also important for tourism. People travel to coral reefs for fishing or diving, providing local hotels, restaurants, and other businesses with visitors and income.

**Coral Bleaching**

Coral bleaching happens when water temperatures rise. When water is too warm, corals will get rid of the algae living in their tissues. This causes the coral to turn completely white. Bleaching events stress corals and often they do not survive.

Why are healthy habitats important to all organisms in a food web?

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How might the loss of a coral reef change the ocean or the sea food web?

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## Activity 8

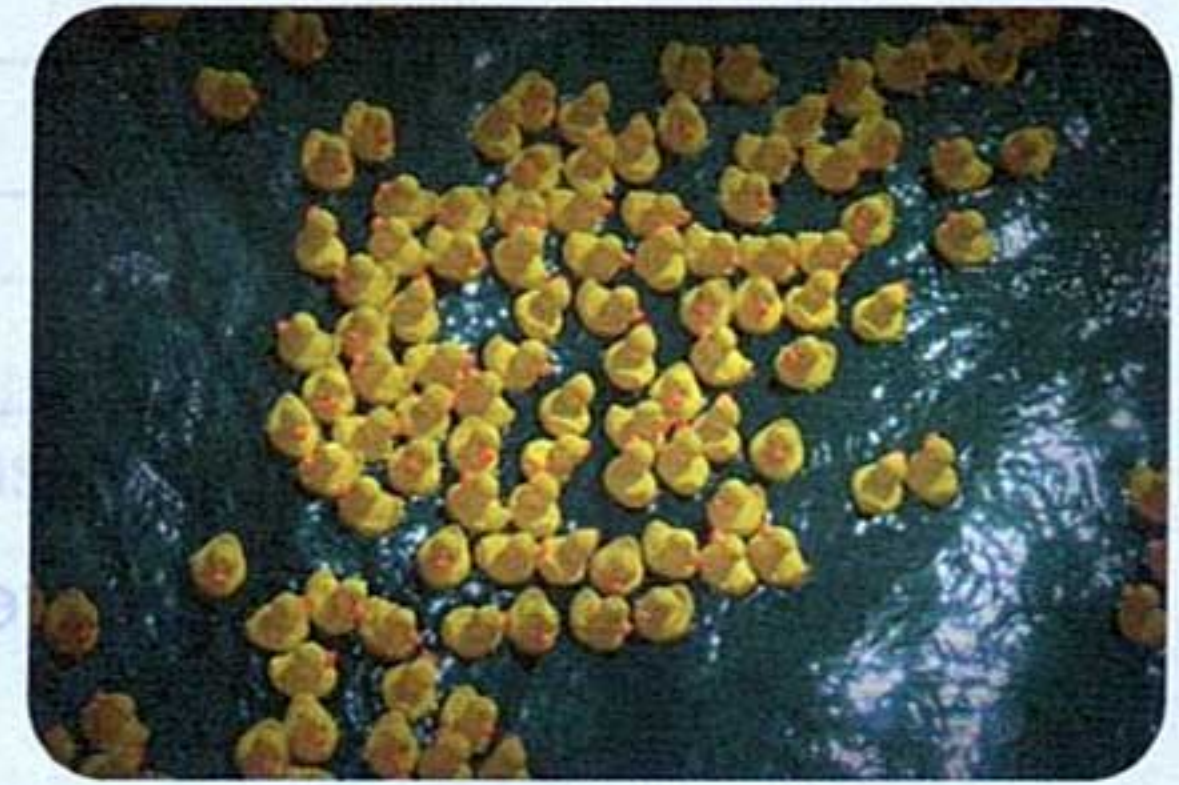
## Analyze Like a Scientist



## Plastic Pollution

Read the text to learn about the effect of plastics in the marine environment. Discuss what you learned with your class. Then, answer the questions.

Large amounts of plastic are thrown in the marine environment every year. Most of it comes from land, plastics affect marine life. Whales, turtles, seabirds, and fish cannot often tell the difference between real food and plastic. For example, a sea turtle cannot see the difference between a jellyfish and a piece of plastic in the water. So, sea turtles eat a lot of plastic thinking that it is jellyfish. Plastic is not nutritious. It can also be toxic and sharp, so it is really bad for animals.



Plastic products get broken down into smaller pieces. Some pieces are even smaller than a grain of rice. We call them **microplastics**. Coral filters the seawater to get its food. When coral does this, it also ingests the microplastics that are as small as the pieces of food that it is getting from the water.

What do you think might happen if the amount of plastic in the marine environment continues to rise?

What is something you could do to help reduce the amount of plastic that ends up in the marine environment?

**Life Skills** I can predict possible outcomes of an event.





**Activity 9**

**Record Evidence Like a Scientist**



**Protecting Ecosystems**

Now that you have learned about changes in food webs, read the text about Palau's marine environment. You first saw this in Wonder.

How can you describe Protecting Ecosystems now?

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How is your explanation different from before?

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Look at the Can You Explain? question. You first read this question at the beginning of the concept.



**Can You Explain?**

What might happen to a food web when an organism or the environment changes within an ecosystem?

Now you will use your new ideas about changes in food webs to write a scientific explanation that answers the Can You Explain? question. To plan your scientific explanation, first write your claim. A claim is a one-sentence answer to the question you investigated. It answers, What can you conclude? It should not start with yes or no.



My claim:

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---

Next, record the evidence that supports your claim. Evidence can come from videos, readings, interactives, and Hands-On Investigations.

Evidence:

---



---

Now, write your scientific explanation and include your reasoning.

Scientific explanation with reasoning:

---



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**Life Skills** I can be reflective





## Activity 10

## Analyze Like a Scientist

## Habitat Restoration

Read the text, then complete the next activity.

Human activity can cause major changes to the environment. Riverbanks erode when too many plants are removed. Floods may reach farther inland when wetlands are drained. Once harm has been done to the environment, scientists, engineers, and concerned citizens work on **restoration**. This involves restoring the land and water back to how it was before harm was done. Restoration projects try to repair all parts of the habitat. They try to bring back food and water sources. They also look to recover shelter and space. Most projects are a lot of work and take a long time, but they can have very positive results.



## Protecting and Rebuilding Coral Reefs

One example of restoring a habitat is a coral reef rehabilitation project happening in the Arabian Gulf. Scientists are harvesting small fragments of various coral species and they are moving them to a **nursery**. The nursery is an area in the ocean where the small pieces of coral are nurtured until they can be moved back to the reefs where they were dying. The healthy coral can then continue growing and reproducing to make a thriving reef again. These scientists in the Arabian Gulf also conduct research and study the best coral species to use for future restoration projects. Coastal communities near the reefs have adopted a “zero plastics” way of life in Egypt. By limiting single-use plastics on land.

Construct an argument for why habitat restoration projects and changes in human behavior both are important. Use your understanding of ecosystem changes to support your argument. Then, suggest one way people in your community can help prevent damage to the environment.



# Unit Project



## Solve Problems Like a Scientist

### Unit Project: Build a Miniature Ecosystem

You have learned a lot about ecosystems. Today, you will begin building a miniature ecosystem. It will be a very small ecosystem, so small that it will fit inside two plastic bottles. Work with your team to consider what you could create in such a small space. Once your teacher has given you materials, build your miniature ecosystem. When it is complete, create a model of the transfer of energy.



### My Miniature Ecosystem

Make a detailed drawing of your miniature ecosystem. Use the labels *producer*, *consumer*, and *decomposer* to identify the different types of organisms in your project.

### Modeling the Flow of Energy

After you have built your ecosystem, think about how energy flows through this ecosystem. Create two diagrams to model this transfer of energy. Your diagrams should account for all the energy that enters your ecosystem. If you do not have consumers or decomposers in your bottles, consider what kinds of organisms could be added to complete your models. Include those organisms in your drawings as well.

Terrarium	Aquarium

### Understanding Relationships

Explain how the diagrams represent energy flow in your miniature ecosystem. Predict what would happen if one of the organisms was removed from the ecosystem.

**Life Skills** I can apply an idea in a new way.

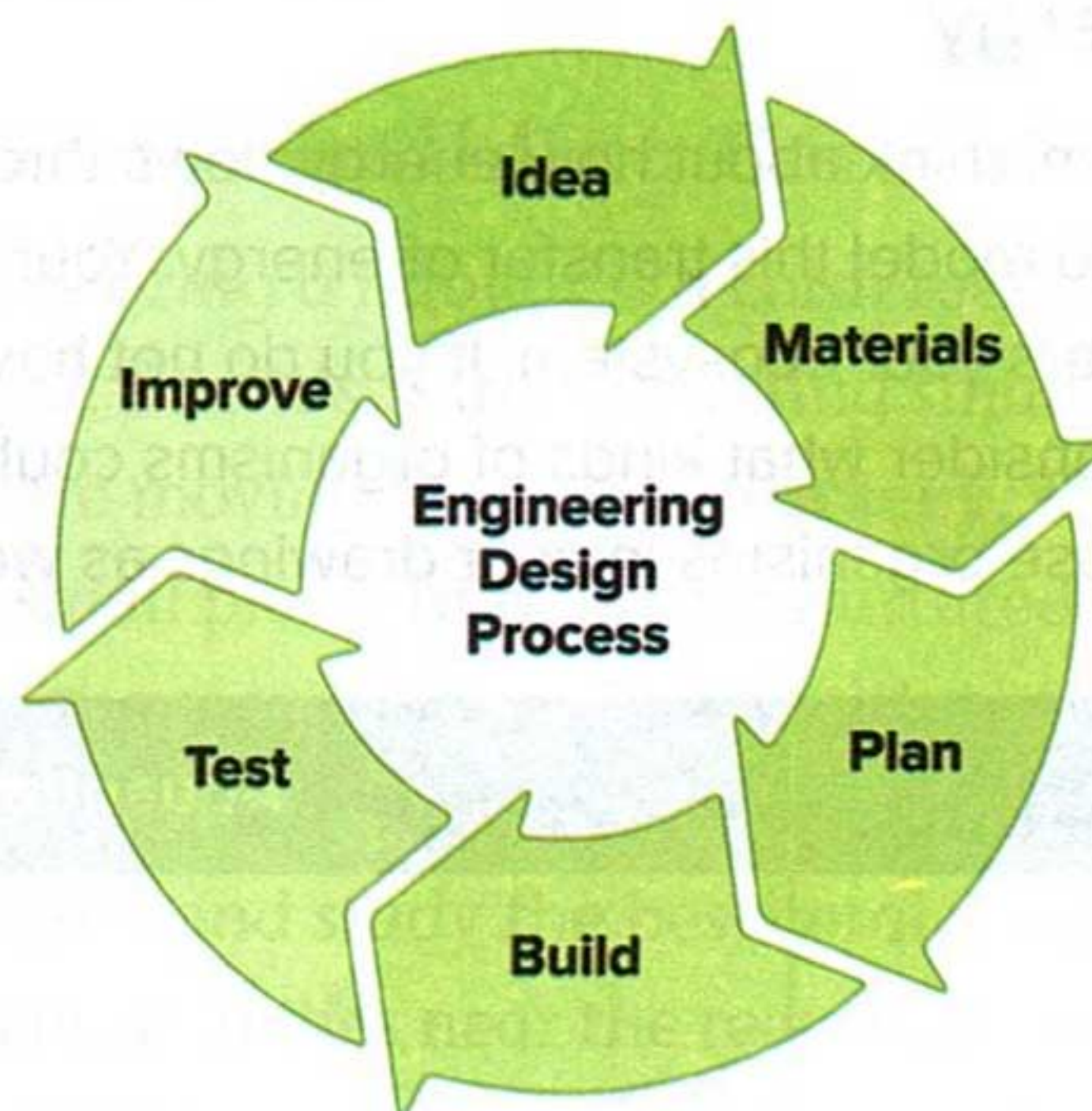


# Interdisciplinary Project



## Interdisciplinary Project: Waste Not, Want Not

In this interdisciplinary project, you will use your science and math skills to find a solution to a real-world problem. First, you will read a story about a fictional group of characters, called the STEM Solution Seekers. Then, you will study some background information, and you will design, test, and refine a solution to the overall challenge. You will go through the steps of the Engineering Design Process, as shown in the diagram. You will also do some additional work in your math class related to this challenge.



The project Waste Not, Want Not challenges you to think about the problem of plastic pollution, especially in waterways. In the story, you will read about a problem that the STEM Solution Seekers observe while walking along a body of water that has been polluted with plastic trash. You will consider ways to reduce the amount of plastic that becomes trash, as well as design and build a product using repurposed plastic.



## Waste Not, Want Not

Friends Seif, Aya, Nour, and Menna are in Seif's hometown while the projects are being judged. "What is all that stuff floating in the water, Seif?" asks Nour. "Is it some kind of seaweed?" Aya says, "It does not look like seaweed to me. It looks like plastic! Look at all the different colors."

"It probably is plastic and other kinds of trash," Seif replies. "We have a big, big, big problem with trash washing up on the shores."

Aya, who has been quiet, adds, "I have heard that this happens in other places of the world too especially down near the ocean. Some of the fish eat the plastic because it looks like food. Other sea creatures get tangled up in the trash."

"Oh, I have heard about that," says Nour. "I believe the Pacific Ocean is full of plastic. It kills all kinds of marine life."

Seif gets excited, "Yes! There is plastic from all over the world in the ocean. I heard about a huge island of plastic in the middle of the Pacific Ocean!"

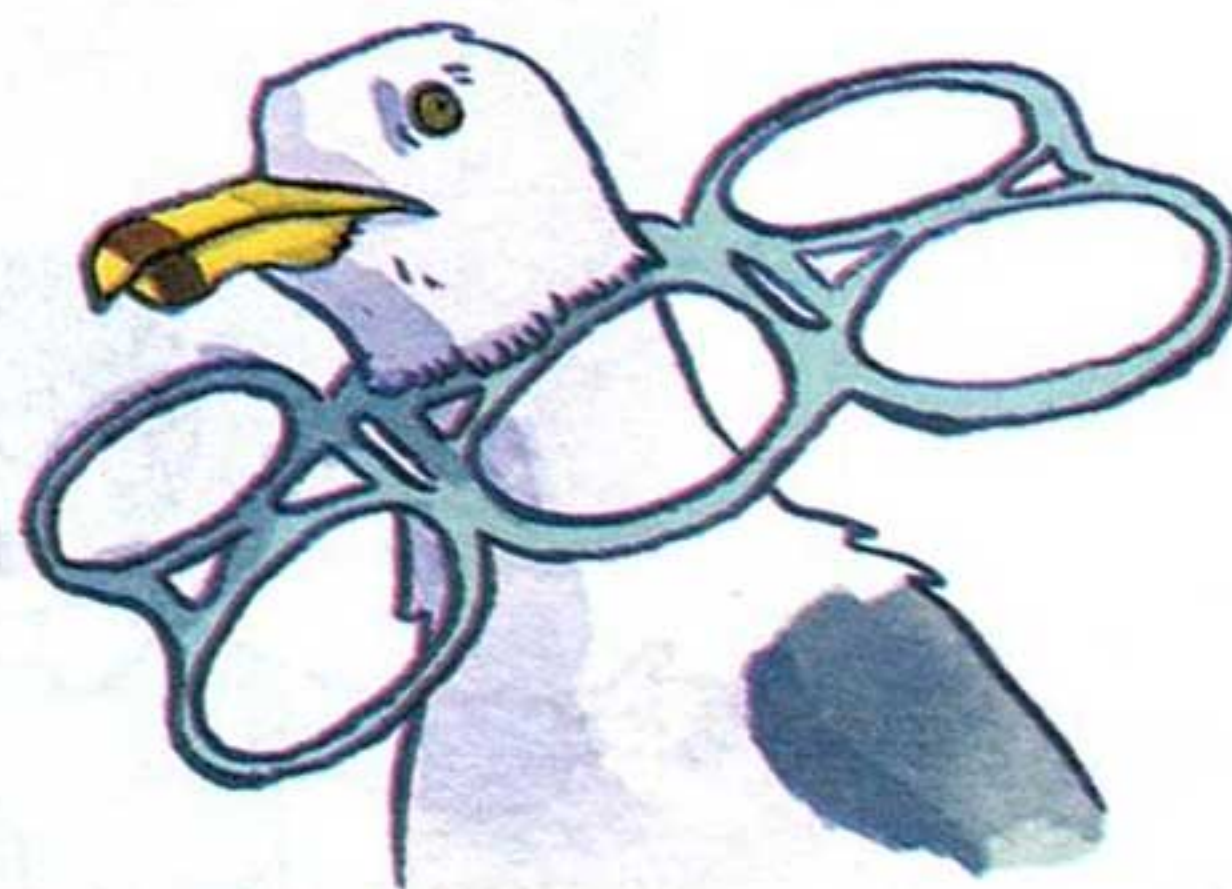
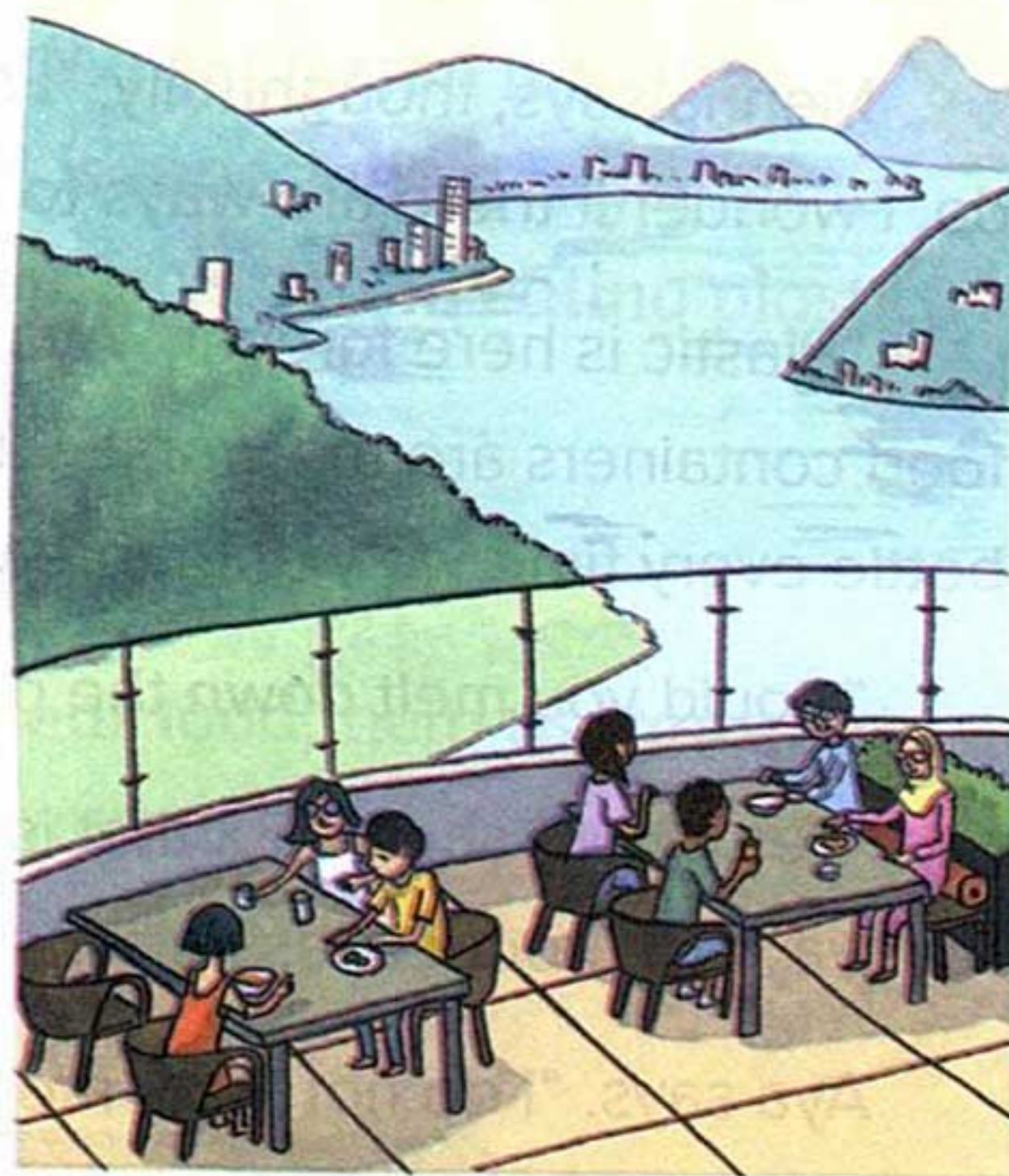
"Did you see the group who presented the trash-eating sea drain at the science fair?" asks Aya.

"Such an amazing idea," Menna exclaims. "I would like to see that on the Mediterranean Sea."

Nour considers, "That drain was really great, but I am not sure it is enough to get rid of everything. Also, it only works on stuff that is already in the water. I think people need to do more to keep trash from getting into the ocean in the first place."

"Are you talking about recycling, Nour?" Aya asks.

Nour has just taken a very big bite of a cookie, so Seif jumps in. "Not just recycling, but also reusing and repurposing and reducing. We produce tons and tons of trash every day. We need to find ways to cut down on what we use and throw away. Too





# Interdisciplinary Project

much of it ends up on the streets and in the water.” As he finishes, Seif is nearly standing up and his arms are in the air.

“Calm down, Seif,” Nour says with a smile. “And, yes, I meant all of those things.”

Menna says, thoughtfully, “I do not think plastic decomposes like other materials do. I wonder if there are ways to reuse some of that plastic.”

“Plastic is here forever,” Aya says, reaching for another cookie. “Water bottles and food containers are the worst, I think. But surely we do not need to use a new plastic bottle every time we want more water.”

“Could you melt down the plastic and make other things with it?” Menna wonders.

“Yes,” Nour says, “but that is not the only answer to the problem. We also need to find ways to produce less plastic to begin with. Maybe use paper and wood instead.”

Aya says, “I do not think more paper and wood will help. But maybe we could use less and turn the plastic into something else, like . . . building materials?”

Seif says, “There are lots of kinds of plastic and lots of kinds of other trash. There must be more ways to recycle and reuse.”

The team agrees and begins to make a list of how they might recycle, reuse, and reduce trash.





## How Bad Is Plastic Pollution?

How did you use plastic today? People use plastic for everything from food storage to medical devices. However, much of the plastic we use ends up getting thrown away. Plastic bags and water bottles are items that often get tossed into the environment. Plastic, as one form of discarded waste, is especially dangerous to animals. Animals can get tangled in plastic rings or suffocate from eating plastic parts.

### Minimizing the Impact of plastic pollution

Plastic is a common material that we use to package our food, help us transport water, and build structures. We know that we will always use plastic in some form in our lives. This is why humans are considering ways to minimize the impact of plastic on the environment in other ways.



Earlier in this concept, you learned about areas in Egypt that have banned single-use plastic. In many places, conservation groups organize volunteers in beach and river cleanups. Volunteers and other people collect plastic trash along the shore. Some people think of ways to reuse their plastic items and containers so that they do not get thrown out to start with. How could you reuse a plastic item in your home and turn it into something you could use again? What other problems could you help solve with your repurposed plastic item?

Many Egyptians advocate for people to recycle more of their plastic to help this problem





## Hands-On Investigation

### Engineering Your Solution

#### Challenge

Your challenge is to design and build something new that you and your teammates can make with plastic bags or bottles. You may also want to incorporate other recyclable materials—just ask your teacher. Consider creating something that you need and that will help you solve a problem or complete a task.



Water Bottle Bird Feeder

#### Objectives

In this activity, you will . . .

- Sketch a prototype for your repurposed plastic design.
- Create your design and list the materials your group uses.
- Describe any problems you encounter and explain how you solve them.

#### What materials do you need? (per group)

- Plastic bottles or plastic bags
- Pencils
- Building materials, such as tape, glue, string, or construction paper
- Digital camera or digital video camera (optional)

#### Procedure

1. **Review the Challenge** Study the challenge and design requirements for this project.

**Life Skills** I can choose the best solution of a problem





2. **Assign Group Roles** Decide the roles for the members of your group and record the names next to each role.
3. **Sketch Ideas** Review the materials available with your teammates and begin brainstorming. Each team member should make their own sketch. Review your sketches as a group and decide on one design to fully develop. Add more details to make it your blueprint that you will use to help you create your solution.
4. **Plan and Build** With your teammates, gather materials and begin building your repurposed plastic item. Make sure to keep track of your steps and process. Follow your group roles and work together. As you build, you will likely run into problems or challenges that you did not anticipate. Keep going. Solve one problem at a time, using your group's creativity to come up with solutions. Try multiple solutions to see what works best.
5. **Reflect and Present** Once your project is finished, reflect on your process and final product. Complete the Analysis and Conclusions section of your student investigation sheet. Identify ways you could improve. Prepare to share with your class.

## Group Roles

Roles	Student name
<b>Team Captain</b> Provide encouragement and support. Help other team members with their roles if needed. Keep track of timeline.	
<b>Materials Manager</b> Gather and organize materials. Request additional materials if needed. Adjust materials as needed (cut, size, fold, and so on).	
<b>Engineer</b> Coordinate building the model. Suggest when a test may be needed. Make sure the team is building safely.	
<b>Reporter</b> Record all steps of the process. Share the process the team went through to complete the challenge.	



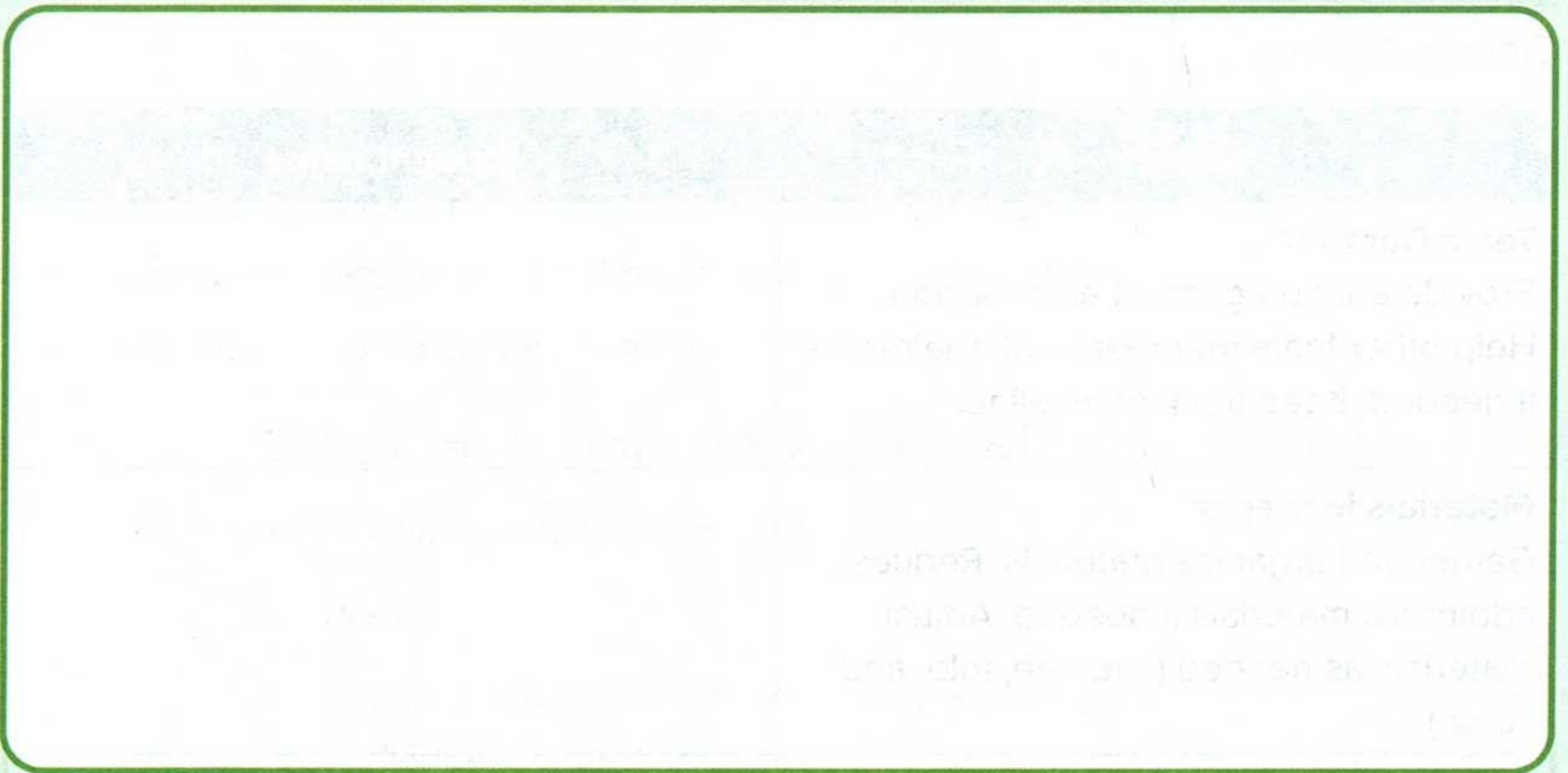
# Interdisciplinary Project

## Design Requirements

- ☐ Your design turns a plastic bottle or plastic bag into something new.
- ☐ Your team's final sketch lists the materials needed and how the design will work.
- ☐ Your group collaborates to use your materials listed to create a repurposed plastic product.

## Sketching Our Design

Sketch your initial idea for how your team can repurpose your plastic bag or plastic water bottle into something new that others could use. After you and your teammates share your ideas, vote on one final design to create, and label the materials needed. Add a sentence to the bottom of your sketch describing how your prototype will work.



With your team, discuss these two questions about your ideas:

- What do you like about these ideas?
- Where can you make improvements to the design?

Circle the final design that you will create.



## Optional Extension

Develop a slogan for your new repurposed product that will teach others about what it does and why they would want to buy it. Include this slogan, with a sketch of your final product, on a poster to advertise your new design. If you have a digital video recorder, create and film a commercial to go along with your poster. Make sure to explain how your new design works and what materials it is made out of.

## Analysis and Conclusions

How does your design turn a plastic bottle or bag into something new?

What materials did you use?

What problems did you encounter as you built your repurposed product? List two problems and how you solved them.

Problem 1:

Problem 2:







## Put (✓) and (X) in front of the following statements :

1. In plants, light energy is converted into chemical energy.
2. Vascular systems differ in plants and humans and do not play the same role.
3. Living organisms depend on each other for getting energy.
4. An ecosystem consists of living organisms only.
5. A food web is a group of interconnected chains that show multiple food relationships.
6. Human activities in the environment affect only living organisms.

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## Rewrite the sentence after correcting the underlined word:

1. Consumer organisms help decompose the remains of dead plants and animals into nutrients that can be returned to the ecosystem.
2. High water temperatures cause coral reefs turn to green.
3. Producing organisms need moon light to perform photosynthesis.

## Answer the following:



In front of you is a group of organisms, of which a food web is formed after completing the organisms, forming a food chain

Explain the levels of organisms in the chain

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